

Component Group: CIL Item:

Propellent Valves

D130-02

Component: Part Number:

Fuel Preburner Oxidizer Valve RS008257

Failure Mode:

Fails to move or moves slowly.

Prepared;

P. Lowrimpre

Approved: Approved Date: Change #: Directive #:

T. Nguyen 6/30/99 2

CCBD ME3-01-5228

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1 of 1

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Phase	Failure / Effect Description	Criticafity Hazard Referen
\$ 4.2	Ween not detectable by SEII, FPOV failure results in failure to establish FPB ignifion or in excessive preburner temperatures. Mission scrub. Loss of vehicle due to turbine overtemperature or LOX-rich operation may result if failure not detected.	1R ME-828
	Redundancy Screens, VALVE SYSTEM - SENSOR SYSTEM; UNLIKE REDUNDANCY.	
	A; Pass - Redundant hardware items are capable of checkoul during normal ground turnaround. B: Pass - Loss of a redundant hardware items is detectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.	
M 4.1	When detected by SEII, out-of-limit valve position results in controller switch to channel 8; continuation of failure mode results in hydraulic tockup of all actuators. Mission abort may result when hydraulic tockup occurs during Max Q throttling.	IR ME-B2M,
	Redundancy Screens: VALVE SYSTEM - SENSOR SYSTEM: UNLIKE REDUNDANCY	ME-86M
	A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround. B: Pass - Loss of a redundant hardware items is defectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.	
M 4.2	When not detectable by SEII, FPOV failure causes engine shutdown due to exceeding turbine discharge temperature. Mission abort.	1R ME-B2M.
7.2	Redundancy Screens: VALVE SYSTEM - SENSOR SYSTEM: UNLIKE REDUNDANCY.	ME-B6M
	A: Pass - Redundant hardware items are capable of checkout during normal ground turnaround. B: Pass - Loss of a redundant hardware items is detectable during flight. C: Pass - Loss of redundant hardware items could not result from a single credible event.	
C 4 T	Out-of-limits valve position results in controller switch to channel B, continuation of failure mode results in pneumatic shutdown; HPFTP overspeed. Loss of vehicle.	
	Redundancy Screens: SINGLE POINT FAILURE: N/A.	

SSME A/UIL

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R\$008267

Fallure Mode:

Fails to move or moves slowly.

Prepared:

P. Lowrimore T. Nguyên

Approved: Approval Dale:

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CCBD ME3-01-5228

Page:

1 of 1

Design / Document Reference

FAILURE CAUSE: A: Seizure of FPOV shaft/bearings.

THE FPOV (1), THRUST (2), AND SHAFT BEARINGS (3) ARE ROLLER BEARINGS. THEY ARE USED FOR THEIR FRICTION AND LOAD CAPACITY CHARACTERISTICS. THE ROLLERS AND RACES ARE 4400 (2) (3), WHICH WAS SELECTED FOR ITS HARDNESS, STRENGTH, AND CORROSION RESISTANCE (4). THE ROLLERS ARE SEPARATED BY A BE-CU RETAINER (2) (3). THE SHAFT BEARING RETAINERS ARE DRY-FILM LUBRICATED (4) TO REDUCE ROLLER-TO-RETAINER FRICTION (3). THE RETAINER PREVENTS ROLLER-TO-ROLLER CONTACT AND MINIMIZES THE ROLLER RUBBING VELOCITY. THE RETAINER PREVENTS SEIZURE CAUSED BY ROLLER SKEWING. THE LOW ROTATIONAL VELOCITY WITH LESS THAN 90 DEGREES TRAVEL PRECLUDES SEIZURE CAUSED BY WEAR OR SPALLING. THE VALVE COMPONENTS ARE CLEANED PRIOR TO ASSEMBLY (5). THE VALVE IS ASSEMBLED IN A CONTAMINATION CONTROLLED AREA (6). THE OXIDIZER SUPPLY TO THE ENGINE IS FILTERED TO 800-MICRONS (7). BINDING OR SEIZURE OF THE FPOY WILL BE DETECTED BY THE ACTUATOR RVDT CONTROLLER MONITOR AND RESULT IN A VEHICLE COMMANDED SHUTDOWN (8). THE MONITOR SYSTEM IS COMPRISED OF REDUNDANT SENSOR ELECTRONICS. REDUNDANT HARNESS, AND REDUNDANT CONTROLLER CHANNELS.

(1) RS008257; (2) RES1032; (3) RES1027; (4) RSS-9582; (5) RL10001; (6) RQ0711-600; (7) ICD 13M15000; (8) CP406R0002 PT 1 3.2 3.6 1

FAILURE CAUSE: B: Broken shaft or coupling.

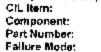
THE 3 PIECÉ COUPLING TRANSFERS TORQUÉ FROM THE ACTUATOR TO THE FPOV SHAFT (1) (2). THE COUPLING PREVENTS SIDE LOADS CAUSED BY ACTUATOR WALVE CENTERLINE MISALIGNMENT. THE SHAFT, UPPER, AND LOWER COUPLINGS (3) ARE INCONEL 718 WHICH WAS CHOSEN FOR ITS CRYOGENIC STRENGTH, DUCTILITY, AND CORROSION RESISTANCE (4). THE INTERMEDIATE COUPLING (5) IS HEAT TREATED NITRIDING STEEL. THIS PROVIDES CORE STRENGTH AND DUCTILITY TO TRANSMIT TOROUGH AND SURFACE HARDNESS TO RESIST WEAR (4). THE INTERMEDIATE COUPLING IS DRY-FILM LUBRICATED TO REDUCE FRICTION AND WEAR (5).

(I) RS008257; (2) RS008262; (3) RS008318; (4) RSS-8582 (5) RS008320

FAILURE CAUSE: ALL CAUSES

HIGH CYCLE AND LOW CYCLE FATIGUE AS WELL AS MINIMUM FACTORS OF SAFETY FOR THE FUEL PREBURNER OXIDIZER VALVE MEET CEL REQUIREMENTS (1). THE FDOV WAS CLEARED FOR FRACTURE MECHANICS/NDE FLAW GROWTH, SINCE IT CONTAINS NO FRACTURE CRITICAL PARTS (2). THE FUEL PREBURNER OXIDIZER VALVE SUCCESSFULLY COMPLETED DVS TEST REQUIREMENTS (3), INCLUDING ENDURANCE (4), AND VIBRATION (5).

(1) RL00532, CP320R0003B, RSS-8546; (2) MASA TASK 117; (3) DVS-SSME-515; (4) RSS-515-17; (5) RSS-515-24



Component Group:

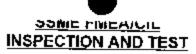
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Prepared: Approved: P. Lowrimore T. Nguyen 6/30/99

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CCBD ME3-01-5226

Page:

1 of 2

Failure Causes	Significant Characteristics	Inspection(s) / Test(s)	Document Pater
A	FPB OXIDIZER VALVE SHAFT SHAFT BEARING THRUST BEARING		Document Reference RS008257 RS008262 RES1027 RES1032
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	RS008262 RES1027 RES1032
		HEAT TREAT IS VERIFIED PER DRAWING REQUIREMENTS	
	LUBRICATION	DRY-FILM COATING OF SHAFT BEARINGS IS VERIFIED PER DRAWING REQUIREMENTS.	RES1027
ASSEMBLY INTEGRITY		DURING ASSEMBLY AND FUNCTIONAL TEST OF THE FPB OXIDIZER VALVE TORQUE ACTUATION IS VERIFIED.	RL00472
		VALVE IS ACTUATED AND RESPONSE TIME IS VERIFIED DURING CONTROLLER FLIGHT READINESS CHECKOUT AND DURING ACTUATOR CHECKOUT.	OMRSD V41AS0 03 OMRSD V41AS0.01
		VALVE IS ACTUATED 10 TIMES DURING HYDRAULIC CONDITIONING. (LAST TEST)	OMRSD S00FA0.21
3	SHAFT COUPLING SLIDER		RS008262 RS008318 RS008320
	MATERIAL INTEGRITY	MATERIAL INTEGRITY IS VERIFIED PER DRAWING REQUIREMENTS.	NGC00320
		HEAT TREAT IS VERIFIED PER DRAWING REQUIREMENTS	
		MACHINED PARTS ARE PENETRANT INSPECTED PER DRAWING REQUIREMENTS.	RS008262 RS006320
	LUBRICATION	DRY-FILM LUBRICATION IS VERIFIED PER DRAWING REQUIREMENTS.	R\$008320
ALL CAUSES	FPB OXIDIZER VALVE		 RS008257
	ASSEMBLY INTEGRITY	FINISHED PARTS ARE VERIFIED CLEAN PER SPECIFICATION REQUIREMENTS.	RL10001
		VALVE IS ASSEMBLED IN A CONTAMINATION CONTROLLED AREA.	RQ0711-600
		VALVE IS ASSEMBLED AND FUNCTIONALLY TESTED PER SPECIFICATION.	RL00472
	HOT-FIRE ACCEPTANCE TESTING (GREEN RUN)	VALVE OPERATION IS VERIFIED THROUGH HOT-FIRE ACCEPTANCE TESTING	RL00461
		VALVE IS RE-TESTED WHENEVER VALVE OR ACTUATOR IS CHANGED OR FPOV OUTLET FLANGE	OMRSD V413Q0.19

FASTENERS ARE LOOSENED

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Page:

2 of 2

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Fallure History:

Comprehensive fallure history data is maintained in the Problem Reporting database (PRAMS/PRACA)

Reference: NASA letter \$A21/88/308 and Rockeldyne letter 88RC09761.

Operational Use:

FAILURE MODE CAN BE DETECTED IN REALTIME BY THE FLIGHT CONTROL TEAM WHO WILL EVALUATE EFFECTS UPON VEHICLE PERFORMANCE AND ABORT. CAPABILITY. BASED ON THIS EVALUATION THE APPROPRIATE ABORT MODE OR SYSTEM CONFIGURATION WILL BE SELECTED, FAILURE DETECTION CUES AND ASSOCIATED SSME PERFORMANCE DATA HAVE BEEN COORDINATED BETWEEN THE ENGINEERING AND FLIGHT OPERATIONS ORGANIZATIONS WITH THE

RESPONSES DOCUMENTED IN MISSION FLIGHT RULES.



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1

CCBD ME3-01-5226

Page:

1 of 1

					Root Side Not	Critical Initiel Flaw Size Not Detectable	
Companent	Basic Part Number	Weld Number	Weid Type	Class	Access	HCF LCF	Comments
BELLOWS	RS008230	3,4	GTAW	1	X	x	
BELLOWS	RS00823D	5-7	GTAW	1			
SHAFT	RS008252	1,2	EBW	II	х	x	